TOWARDS A SET OF RECOMMENDATIONS ABOUT HOW TO IMPLEMENT GEOPORTALS IN SDI NODES

A. F. Rodríguez[1], P. Abad[1], J.A. Alonso[1], A. Sánchez[1], C. González[1], C. Soteres[1], M. Juanatey[1], E. Díez[1], H. Potti[1]

[1]Instituto Geográfico Nacional
C/ Gral. Ibáñez Ibero, 3, 28.003 Madrid
afrodriguez, pabad, jaajimenez, asmaganto, gonzalezc, csoteres, mjuanatey, ediez, hpotti@fomento.es

Abstract

The more visible face of an SDI is a set of standard resources available in the Net, services, clients and applications, usually published and known throughout geoportals, defined in INSPIRE Directive as Internet sites providing access to spatial data services.
The standardization of the components of a geoportal follows some rules established at several levels: international standards (ISO), regional and national standards; OGC and other web standards; European or regional Directives and Implementing Rules, national legislation, other rules, and so on. In particular, a lot of very practical issues need to be taken into account and probably recommended as good practices to maximize the benefits and exploitation of such essential Information Infrastructures.

This communication tries to define a first draft with a set of recommendations, some of them extracted from the existing legal frameworks, about how to implement geoportals and viewers following two main criteria:

- To make them as general, flexible, interoperable, versatile, universal, open, usable and standard as possible.
- To maximize the number of users and developers using them by means of an effective plan of diffusion and outreach.

Some of the points recommended are: multilinguism, design, availability, performance, technological neutrality, flexibility of the viewer, services chaining standardization, user's feedback, and outreach.

Most of existing geoportals doesn't fulfil all the considered aspects and that is the reason why we think each body responsible of the implementation of an SDI, geoportal or viewer, is now in the position of taking into consideration the possibility of defining a set of practical criteria for making their website more standard, universal, usable and well known.

Introduction

The more visible face of an SDI is a set of standard resources publishing Geographic Information or related data, available in the Net: services, clients and applications. Usually the set of available resources published by a local, regional or national SDI are

arranged in a web site named geoportal. European Directive INSPIRE (2007/02/EC)[1] defines a geoportal as an Internet site providing access to spatial data services. We think this concept is worldwide understood in this sense, a geoportal is generally considered to be a web site including one or more clients for accessing geospatial services.

The standardization of the components of a geoportal follows some rules established at several levels: international standards (ISO), regional and national standards; OGC and other web standards; European or regional Directives and Implementing Rules, national legislation and other rules and recommendations. In particular, a lot of very practical issues need to be taken into account and probably recommended as good practices to maximize the benefits and exploitation of such essential Information Infrastructures.

In this context, the harmonization of the services, beyond the requirements defined by OGC (Open Geospatial Consortium) and ISO (International Organization for Standardization) standards, has been considered by several initiatives: INSPIRE Implementing Rules about Network Services[2], "Recommendations for implementing WMS"[3] defined by the Spanish National Geographic High Council, among other initiatives.

But client application harmonization has not been taken into consideration sufficiently. There is no document or initiative under development dealing with topic: harmonization of client applications beyond OGC and ISO standards.

The standardization and harmonization aspects considered in this paper are relevant for geoportals of reference, the geoportals playing the role of one stop portal and point of contact for a country, region, municipality or other administrative area, and geoportals wanting to play the same role for a particular theme, for instance archaeology, environment, or climatology.

From a very pragmatic point of view, a lot of very practical issues need to be taken into account, and probably recommended as good practices, to maximize the benefits and to make easier the exploitation of such essential Information Infrastructures.

In next section, we will review briefly a model of interoperability to describe in which level of abstraction are we going to develop our suggestions. Then, a list of recommendations to maximize the good points and advantages of geoportals and viewers is given for discussion.

An interoperability model

Interoperability is defined as the ability of a system to provide information sharing and inter-application co-operative process control (ISO 19101:2003 Reference Model), or in other words, the possibility for spatial data sets to be combined, and for services to interact, without repetitive manual intervention (Directive 2007/2/EC).

[1] http://eur-lex.europa.eu/JOHtml.do?uri=OJ:L:2007:108:SOM:EN:HTML
[2] http://inspire.jrc.ec.europa.eu/implementingRulesDocs_ns.cfm
[3] http://www.idee.es/resources/recomendacionesCSG/RecomendacionServicioMapas.pdf

In order to describe measures and actions to improve interoperability of geoportals it would be convenient to take into account some of the available interoperability models defining some levels as independent and different categories of aspects and factors determining interoperability.

The levels of interoperability considered in the Metadata Based Interoperability Model (MBIM) (M. A. Manso and others, 2007), which has been defined as a synthesis of the main and more known models of interoperability, are:

I) Technical Interoperability (TI), taking into account the interchange of data and messages by mean of protocols at the lowest level, at level of bits.

II) Syntactic Interoperability (SNI), dealing with the available standardized format to interchange data and messages (XML, JPEG, PNG, GIF,).

III) Semantic Interoperability (SMI), allows the interchange of information using common and standardised vocabularies, terms and definitions to have a common understanding of the data and messages interchanged.

IV) Pragmatic Interoperability (PI), making possible that systems can exploit and use other system services (services metadata and specifications).

V) Dynamic Interoperability (DI), focused on the ability of systems to react to errors and miscommunication in a dynamic way.

VI) Conceptual Interoperability (CI), covering all the aspects needed to know and reproduce the functionality of system, normally based on engineering standard descriptions (UML schemas, CASE tools, DescribeFeatureType operation).

VII) Organizational Interoperability (OI), considering the business objectives, business model, data and services policy, legal framework, organizational structure and others aspects related.

Technical Interoperability is covered by W3C standards and protocols; Syntactic, Semantic and Conceptual Interoperability are considered by ISO 19100[4] standards and INSPIRE Implementing Rules, but there is some room for practical harmonization and coordination in some practical aspects; Dynamic Interoperability aspects are faced in practical implementations and is included as a key-issue in choreography and orchestration of services (WS-BPEL, RestFUL and other solutions).

Pragmatic and Organizational Interoperability are the two main levels where some significant progress can be made as far as they are not directly addressed by INSPIRE Implementing Rules nor any other initiative, as far as we know, and because they includes a lot of practical issues that need to be managed by ad hoc recommendations.

[4]http://www.isotc211.org/

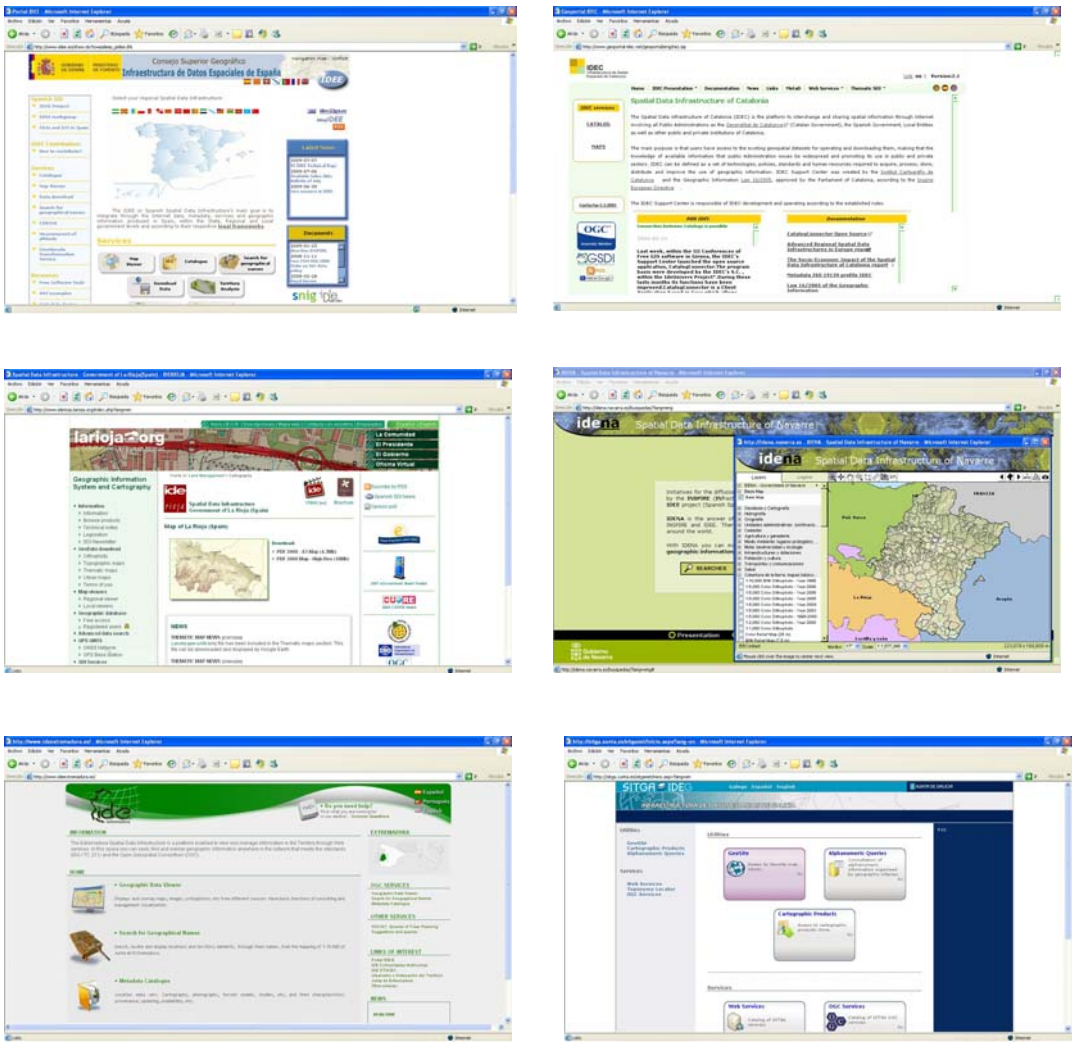

Figure 1: Some multilingual geoportals from Spanish NSDI

Methodology

We have tested, as far as IGN Spain is responsible for the coordination of Spanish NSDI since 2002, most of the geoportals available in the Spanish NSDI, which can be seen as a SDI of SDIs, composed by 9 national geoportals, 16 Regional SDIs, more than 300 local geoportals and several thematic SDIs (Abad P. and others, 2008). This situation has given us a quite wide universe of implementations showing different approaches, situations and problems.

As part of the activities developed during the international course on SDI, celebrated in Madrid during july 2008, and organized by AECID (International Cooperation for Development Spanish Agency) with the collaboration of the National Geographic Institute of Spain (IGN Spain) and the Technique University of Madrid (UPM), the

practical interoperability of all the geoportals of Latin America were checked and a preliminary set of conclusions was published in "Newsletter-IDE Iberoamérica".[5]

Furthermore, the most known geoportals in the world has been checked and tested looking for practical aspects acting as barriers limiting its interoperability and outreach. We had paid special attention to geoportals listed in GSDI[6] web page.

The methodology applied has been quite informal and it has been based on our experience managing the national node of IDEE (Spanish NSDI). We consider ourselves as specialized users, with some background in cartography, geomatics and SDI, but we have completed an analysis of each portal looking for facts, approaches and characteristics limiting the interoperability of geoportals and their usage for all kind of users, advanced ones and beginners.

Recommendations

We have divide'd the points considered into general recommendations about the geoportal as a whole, including all the components implied, specific recommendations about the viewer and some considerations about other client applications.

A) Geoportals

1) Web browsers. A geoportal shall be compatible with the most extended and used web browsers (for example Microsoft Internet Explorer, Mozilla Firefox, and Google Chrome).

2) Multilinguism. It would be wise to include interfaces in English, all the official languages of the country, the languages of the neighbour countries and in the most common and extended languages in the region or continent (see fig. 1).

Generally speaking, it would be a good idea to consider as many languages as possible. A better solution would be to offer to the users a web application to produce their own interface in their mother tongue. To open a geoportal in the net means to competes for the audience in an international multilingual arena. IDEE geoportal have had visits from 149 different countries because it includes versions in seven different languages (see fig. 2).

3) Openness. The general access to the geoportal shall be free, open and without any kind of user register, username and password.

Some contents can be not public but the main entrance and the general contents must be free and as open as possible.

4) Identity. It is necessary to clearly declare and describe in the web pages which organization plays the role of creator and is responsible for the maintenance of the geoportal. It would be also necessary to explicitly declare the objectives wanted by implementing the geoportal.

[5] http://redgeomatica.rediris.es/newsletter/Newsletter_v4_08.pdf
[6] http://www.gedi.org

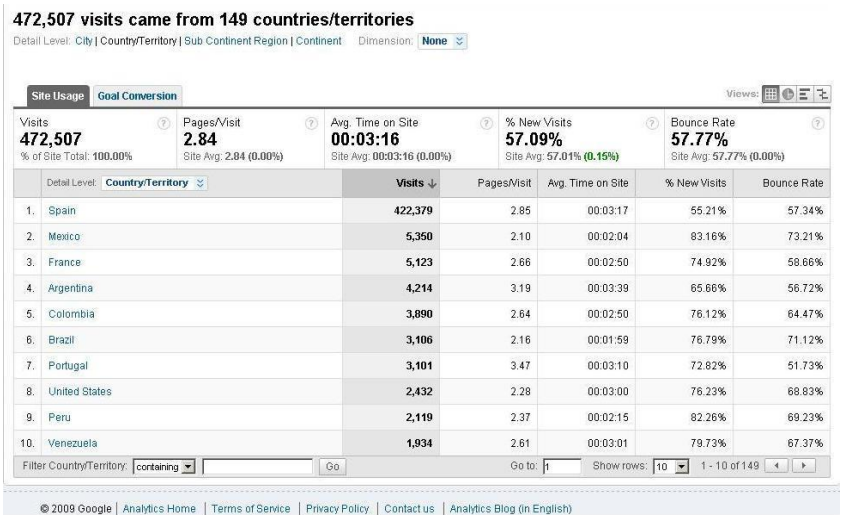

Figure 2: Page showing the origin of Spanish NSDI geoportal visitors

This kind of information gives a sort of indirect guaranty to the user about the quality of the cartography and the continuity of the service in the future, depending on the corporative image of the body responsible for the geoportal.

5) Feedback. Contact details, at least an e-mail address, is also needed to receive suggestions, get feedback from the users and answer possible complaints and questions.

Other mechanisms for getting feedback from the users, like enquiries, digital forums, blogs… can be also recommendable. To take on board users' requirements and points of view is essential to satisfy their actual needs and requirements.

6) Usability. As defined in ISO 9241, usability is the ease with which people can employ a particular tool in order to achieve a particular goal. To have a web map to make easy to the user to find contents, to have a help option in each page, or videos showing how to use the geoportal, are options to increase usability. This is one of the weak points of SDI geoportals and viewers implemented until now and it is necessary to make an effort to improve this aspect.

7) Accessibility. The WAI (Web Accessibility Initiative), describes accessibility as the property of a web page of being easily used by people with disabilities.

It is extremely difficult to make Geographic Information viewers usable, because cartography is essentially visual, but at least the static pages can be accessible at some level and the best effort must be done for this purpose.

8) SDI declaration. The geoportal shall define itself as an SDI resource, having standard services and being interoperable.

It's quite strange to find examples of geoportal with a title including the word GIS and any reference at all to SDIs, standard services, OGC…

9) Services URL. The geoportal shall give publicity in a preferential place to the URL address of the services available at the node where it is.

This is the best way to promote and facilitate that users can see and use the geospatial services available in their favourite light or thick clients.

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10) Three basic services. We consider that the Basic and most used services in a SDI node are visualization services, data and/or services discovery services and gazetteers. A geoportal must give access at least to this three basic type of service. The services can be published by the same organization and node, or can be remotely invoked.

Visualization services are the most widely used and they exploit the efficiency of visual and cartographic communication. Discovery services, or catalogue services, are essential to search and discovery available data and/or services to work with. Gazetteers are the most natural way to search a feature or a particular region of interest.

11) Legal information. Information about authorship, copyright, terms of use and access constraints of the contents of the geoportal needs to be included to clearly inform users about this key point to reuse information.

12) Availability. High availability, higher than 99.9% on a monthly basis, is a clear requirement not only for web services, but also for client applications, web static pages and all the components in a geoportal.

13) Performance. In spite off the fact that the services performance is the most relevant factor affecting the performance perceived by the user, there are two relevant aspects to be taken into account when the client part is considered: the performance of the web pages server; and the time consumed in the process of opening the viewer. Both parameters must be optimized because they have a great impact in the opinion of all kind of users.

The two last aspects are very important not only for practical purposes but also to get the best possible corporative image. For this purpose the objective must be more ambitious than just reach the minimum requirements and must based on the idea of offering the best possible parameters.

14) Good design. Visual design is an important aspect to have an appealing and effective geoportal and it is always a god idea to invest some time and money just in finding a modern, attractive and good design.

15) Neutrality. We think a geoportal must strictly maintain technological neutrality with respect to the technical and commercial solutions existing in the market. That implies that the information about the solutions employed in the implementation of the geoportal, and all the components implied, must be available only in a specific area for being consulted, for instance in a “about” option. Indirect promotion or publicity or any commercial or free software solution must be avoided.

16) Outreach. A geoportal need to be mentioned and linked in any relevant thematic web site or geoportal related in some way, specially geoportals of SDIs with a greater territory covered (GSDI, National SDIs…). Of course a diffusion strategy and plan is

needed, including publications, papers, presentations, workshops and all kind of events, and other mechanisms like newsletter, bulletins, blogs, feeds like rss or atom…

II) Viewers

17) Standardization. The interface between the viewing client application, the viewer, and the server part shall be standard and fully conformant with OGC Web Map Service specification and ISO 19128. A example of WMS standard petition is given below:

http://www.idee.es/wms/IDEE-Base/IDEE-Base?TRANSPARENT=false&VERSION=1.3.0&BGCOLOR=0xFFFFFF&SERVICE=WMS&REQUEST=GetMap&STYLES=default&EXCEPTIONS=application%2Fvnd.ogc.se_inimage&FORMAT=image%2Fjpeg&LAYERS=Todas&CRS=EPSG%3A4258&SRS=EPSG%3A4258&BBOX=-20.617096880907372,27.361599999999995,6.230196880907371,43.8184&WIDTH=863&HEIGHT=529

This point can be easily checked using a sniffer (i.e.: httpwatch[7], tamper data[8],) to capture the petitions of the viewer and comparing with the standard format:

Some viewers don't use the standard protocol in the communication with the server. When an external WMS is invoked, they use an intermediate server that translates the standard petition GET MAP into a non-standard petition.

This kind of solutions has a lot of disadvantages: non-promotion of standards; risk of different result when using the standard and the non-standard protocol; possible overload of the system translating the requests…

18) Adding WMS. It must be possible to invoke a new WMS to the viewer by introducing its URL in a dialogue box.

This point enhanced a lot the possibilities of application of a viewer and its interoperability. There is a wide variety of use cases where this function is required.

19) Spatial extent. Generally speaking a standard viewer must not have any restriction in the spatial extent that the user can display at a particular scale. In principle, the entire world must be available to be explored by mean of pan function.

This aspect limits a lot the possible applications of the viewer without implying any advantage.

20) CRS supported. A viewer must support the official and the most used Coordinates Reference System(CRS) in the area of interest and the global ones. In any case, WGS84 with latitude-longitude (EPSG: 4326) shall be supported as the most used global CRS.

21) CRS management. The viewer shall display the current CRS used in each moment and it is very recommendable the functionality of changing the CRS in the viewer,

[7] http://www.httpwatch.com/
[8] https://addons.mozilla.org/es-ES/firefox/addon/966

performing an on-the-fly and approximated transformation to display at the same time different WMS that doesn't share any common CRS.

22) Viewing services compatibility. A viewer must be compatible with all relevant viewing standards at each moment. For instance, now we have OGC WMS (Web Map Service)[9] and OSGEO WMS-C (Web Map Service – Cache)[10], and in a near future WMST (Web Map Service – Tiled).

23) Viewer performance. It is not a critical aspect because the impact of services performance is much grater, but anyway it is necessary to optimize the influence of the viewing application into the total response time perceived by the user.

24) No logo. Any logo, watermark, copyright information or any kind of message shall be removed from the interior of the geographic window.

If the viewer displays any kind of message, watermark or logo into the display window, there is a lot of disadvantages: the information can overlay other messages displayed by WMS; in some situations, messages can be understood as geographical names; message can understood as applicable to any WMS displayed in the viewer;…

In any case, in classical cartography there is a clear distinction between cartographic information and marginalia. We think it is a good idea to maintain this conceptual distinction as clear as possible in web cartography.

25) Help. A very usable help functionality must to be implemented to help users to use and exploit properly all the functionalities of the viewer. The usage of digital videos to show how the viewer works is a very interesting and usable solution.

26) Basic services chained. The two other basic services, as mentioned above, Catalogue and Gazetteer services, need to be chained with the viewer. This way, the user can look for a feature by name in the Gazetteer service, or for a dataset in the Catalogue, and he can easily see the result in the viewer.

Reverse chaining must be also possible: to look for a geographical name from the viewer interface invoking gazetteer service; and search in the catalogue the metadata of a particular service or a dataset displayed in the viewer.

27) Advanced services chained. Other types of services implemented and available in the geoportal (Web Map Context, Style Layer Descriptor, Web Feature Service[11]) need to be also chained with the viewer functionality.

28) Get feature information. The operation GetFeaureInfo, as defined in OGC WMS standard, must be supported for the viewer in order to show the attributes available and defined as public in each point of the map.

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[9] http://www.opengeospatial.org/standards/wms
[10] http://wiki.osgeo.org/wiki/WMS_Tile_Caching
[11] http://www.opengeospatial.org/standards

29) Legend. The viewer shall allow users to display the legend correspondent to each WMS being viewed in order to make possible the correct interpretation of the cartography.

Most of the general requirements explained above, referring to viewers and geoportals, can be extended to other clients to access geoservices, taking into account the specifics of each service, with the same objectives: to increase flexibility, openness and interoperability of SDI nodes implementations.
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Conclusions

The aspects mentioned above are sometimes applicable to the web services (performance, no logo, standardization, openness, neutrality…), but we have left this side of the problem to emphasize the effort need in the geoportals implementation and management.

The relevance and cost of the points listed above are very variable. Perhaps it is necessary to say that some of them are more fundamental than others. We think some points, as web browsers, multilinguism, identity, usability, services URL, three basic services and outreach, are specially important because has a great impact from a practical point of view.

On the other hand other points, as openness, standardization, legal aspects, adding WMS, chaining services, neutrality, spatial extent, CRS supported, no logo and legend, are very significant because implies theoretical and philosophic principles of the main importance.

Most of existing geoportals doesn't fulfil all the considered aspects and that is the reason why we think each body responsible of the implementation of an SDI, geoportal or viewer, is now in the position of taking into consideration the possibility of defining a set of practical criteria for making their website more standard, universal, usable and well known.

The final objective of this communication is to serve as kick-off contribution to debate and fix a set of recommendations to make SDI geoportals, viewers and clients: on the one hand more flexible, general and adaptable; on the other hand more opened, accessible and standard. It can be used also as a start point to establish a checklist to verify the quality and interoperability of geoportals.

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